Properties of Matter

5-4 The student will demonstrate an understanding of properties of matter. (Physical Science)

5-4.2 Compare the physical properties of the states of matter (including volume, shape, and the movement and spacing of particles).
Taxonomy level: 2.6-B Understand Conceptual Knowledge

Previous/Future knowledge: In 2nd grade (2-4.1), students recalled the properties of solids and liquids and in 3rd grade (3-4.1) students classified different forms of matter (including solids, liquids, and gases) according to their observable (shape) and measurable (volume) properties. Students have not been introduced in previous grades to the concept of particles of matter and how they are affected by the states of matter. Students will further develop this concept in the 7th grade (7-5.10) as they compare physical to chemical changes.

It is essential for students to know that solids, liquids, and gases can be compared based on their physical properties (including volume, shape, and the movement and spacing of particles):

Solids
- *Solids* have a definite shape and volume.
- Particles in a solid are very close to one another (dense) and vibrate, but stay in the same place.
- The volume of a solid with rectangular sides can be determined by measuring with a ruler and calculating height x width x length.
- The volume of an irregularly shaped solid can be determined by water displacement in a graduated cylinder.
- The volume of water displaced equals the volume of the object.

Liquids
- *Liquids* have a definite volume, but their shape changes according to the shape of their containers.
- The particles are also close to one another, but they are able to move apart from each other and flow from place to place.
- The volume of a liquid can be measured using a graduated cylinder or graduated syringe.

Gases
- *Gases* have no definite shape or volume, but take the shape and volume of their containers, filling the space available.
- The particles easily move far apart from each other and spread out through the available space.

It is because of the movement and spacing of particles of matter that the volume and shape of solids, liquids, and gases differ.

It is not essential for students to know that the volume of a gas changes with pressure changes or how temperature changes can affect volumes of gases, liquids, and solids. Students do not need to know how to measure the volume of a gas.

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Assessment Guidelines:

The objective of this indicator is to *compare* the physical properties of the states of matter; therefore, the primary focus of assessment should be to detect ways the physical properties of solids, liquids, and gases are alike and different, including their volumes, shapes, and movement and spacing of particles. However, appropriate assessments should require students to *interpret* a diagram of particles of matter in solids, liquids, and gases and to *recognize* which diagram of particles is associated with which state of matter based on the movement and spacing of the particles; to *interpret* a diagram of measuring tools to determine the volume of solids or liquids; and to *recognize* which state of matter is described given various physical properties.